Thyroglobulin levels are useful indicators in patients rendered athyrotic because detectable levels of thyroglobulin can be identified in persons without thyroid disease and elevated levels can be seen in patients with autoimmune disease of the thyroid. However, the level of thyroglobulin is of no value in the separation of benign from malignant thyroid nodules.

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Regional Cerebral Blood Flow

IN CONTRAST to the qualitative estimate of cerebral blood flow obtained with a routine brain scan, a more precise estimation of regional cerebral blood flow can be obtained using freely diffusible xenon 133 gas. The washout of the radioactive gas from the head is monitored using either one or several radiation detection probes to calculate cerebral blood flow. Xenon 133 may be injected into the internal carotid artery by way of catheter or peripherally into a vein, or it may be inhaled and passed into the bloodstream by way of the pulmonary capillaries. Although the amount of blood flow in grey matter is of greatest importance, the probes can measure radioactivity in white matter and, with intravenously given or inhaled xenon 133, in extracerebral tissues as well. To differentiate between these compartments, washout is monitored for at least ten minutes. The first portion of the biphasic washout curve is assumed to be produced by activity in the grey matter, with the second portion primarily produced by activity in the white matter and extracerebral tissue. Equations derived from the Fick principle are applied to the curve to calculate regional blood flow in both white and grey matter. Sources of error include scattered radiation from outside the probe field of view, an unknown contribution to the count rate from extracerebral tissues and the pronounced effect of the partition coefficient (or differential solubility in tissue) of ^{133}Xe, which may vary greatly in areas of abnormal tissue.

In spite of the sources of error, the procedure provides sufficient information to be useful in the diagnosis and follow-up after surgical treatment of cerebrovascular disease. It is also useful in conditions of low blood flow such as dementia and after severe head injuries as well as to show the response to ventricular shunting in normal pressure hydrocephalus.

Because of the value of quantitating cerebral blood flow, better methods of estimation are being sought. One involves use of krypton 81m, a gas with a 13-second half-life, to show arterial flow. Others use an emission computed tomographic scanner, with a positron-emitting radionuclide to demonstrate distribution of blood flow in the brain. As yet, these methods are confined to a few research centers.

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Adrenal Scintigraphy

IN 1970 iodocholesterol labeled with iodine 131 was introduced for scanning the adrenal glands. Since 1975 iodomethylnorcholesterol ^{131}I has been the agent of choice because of its higher organ-to-background ratio. Adrenal scintigraphy can be used to demonstrate adrenal structure and function in a manner similar to radioactive iodine scintigraphy being used for the thyroid gland. In more than 95 percent of cases of Cushing syndrome, the adrenal scan can differentiate between hyperplasia, carcinoma or adenoma. An autonomously functioning, unilateral, adrenal adenoma can be detected before the disease is evident clinically, even when plasma cortisol levels are still normal.

Adrenal scintigraphy is the most sensitive method for localizing hyperfunctioning adrenal remnants following bilateral adrenalectomy. Adrenal suppression with dexamethasone can be used to demonstrate aldosterone- or androgen-producing adenomas which appear as a unilateral increase in uptake. The specificity of suppression scans for lateralizing aldosterone-secreting tumors is 94 percent. The advantage of this method is the elimination of adrenal arteriography and venography particularly when the scan demonstrates unilateral pathology. These radioactive cholesterol agents do not concentrate in medullary tissue; therefore, the procedure is less sensitive

for pheochromocytomas which must be at least 2 cm in diameter and distort the cortical tissue before detection is possible.

Preliminary results of adrenal scanning indicate its potential benefit in low-renin essential hypertension. Patients with nonsuppressible adrenal glands responded well to spironolactone therapy; poor response to such therapy has been found with normal adrenal suppression.

Administration of corticosteroids will cause poor or absent adrenal uptake. Information about the patient's medication is important to avoid spurious interpretation of scan findings while the adrenal glands are being stimulated or suppressed in the course of endocrinologic evaluations.

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Radionuclide Technique for Detection of Acute Gastrointestinal Bleeding

ONE OF THE most challenging problems faced by clinicians in testing patients with acute gastrointestinal bleeding is locating the exact site of the bleeding. While angiography and endoscopy are excellent procedures, they are invasive, require well-trained personnel and present some risk to the patient. Radionuclide studies are noninvasive and are more sensitive than angiography in the detection of the bleeding site. The study can be done in a patient's room with a mobile camera and is of particular value for a patient who is too ill to undergo invasive studies.

A new radionuclide technique employed in the detection of gastrointestinal bleeding uses erythrocytes labeled in vivo with stannous pyrosphosphate ^{99m}Tc. Images of the abdomen are obtained immediately and repeated for up to three to four hours or longer, as necessary. Usually it takes less than 30 minutes to detect an active bleeding site. An advantage of this technique is its ability to detect occult or intermittent bleeding over a 24-hour period. Such sites can be identified in patients when the rate of bleeding is as slow as 0.3 ml per minute.

Another radionuclide agent employed in the detection of gastrointestinal bleeding is technetium 99m sulfur colloid, which is given intravenously. The colloid is cleared rapidly by the reticuloendothelial system so that the fraction of injected radioactive colloid that extravasates at the bleeding site can be seen as a focal accumulation of activity.

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Leukocyte Labeling With ^{111}In Oxine for Acute Inflammatory Disease

BECAUSE LEUKOCYTES are involved in the pathological process of inflammation, the ability to label and subsequently image their distribution in the body has long been of interest to both nuclear physicians and clinicians. Recently, a new radioactive agent for labeling leukocytes, indium-111 8-hydroxy quinoline (^{111}In oxine), has been described. This compound labels an intracellular component of the leukocytes. Indium is not eluted after labeling of cells and does not appear to alter the cells' biological function, survival or distribution.

Leukocytes are obtained from a patient's peripheral blood specimen and labeled in vitro with ^{111}In oxine. The autologously labeled leukocytes are injected back into the patient and whole-body imaging carried out. Abnormal radioactivity is observed at sites of leukocyte accumulation, including inflammation and abscess. Because of the high degree of specificity for detecting lesions with inflammatory infiltrates, this technique has been successful both in the identification and localization of abscesses.

Gallium-67 citrate is the alternative radioactive pharmaceutical agent used to detect abscesses. Because it may concentrate in neoplasms and is excreted in the bowel, its use in the detection of abscesses may result in misinterpretation of findings.

Recent comparative studies favor the use of the ^{111}In technique for abscess detection and indicate that it is superior to ^{67}Ga scans. A diagnostic accuracy rate of 92 percent has been reported for ^{111}In oxine leukocyte scanning, comparing favorably with accuracies of 96 percent for computed tomography and 90 percent for ultrasonography.

The disadvantages of this technique include the